IN THE CLAIMS:

1. A device for sensing a torque applied through a shaft, the device comprising:

a shaft;

a bearing attached to the shaft comprising an inner race, an outer race and a plurality of rolling elements;

a magnetoelastic ring press-fit onto the inner race;

an excitation coil placed in close proximity to the magnetoelastic ring;

a sensing coil placed in close proximity to the magnetoelastic ring;

an electric circuit for sensing a change in the ring's electrical conductivity and magnetic permeability.

2. The device of claim 1 wherein the inner race is a tapered race and the magnetoelastic ring is press fit upon a journal adjacent a small end of the tapered inner race.

3. The device of claim 1 wherein the inner race is a tapered race and the magnetoelastic ring is press fit upon a journal adjacent a large end of the tapered inner race.

4. The device of claim 1 wherein the excitation coil and sensing coil are packaged into a single unit mounted to the outer race.

5. The device of claim 4 wherein the single unit is mounted within a radial bore of the outer race.

6. The device of claim 4 wherein the single unit is mounted within a counterbore of the outer race.

7. The device of claim 4 wherein the single unit is mounted within a seal mounted within the outer race.

8. The device of claim 5 further comprising a second excitation coil and second sensing coil packaged into a second unit mounted to the outer race.

9. The device of claim 8 wherein the second unit is mounted to the outer race opposite the single unit.

10. The device of claim 4 further comprising a second excitation coil and second sensing coil attached to the outer race opposite the single unit and electrically connected to the single unit.

11. The device of claim 1 wherein the electrical circuit comprises:

a bridge balancing circuit that receives an output of the sensing coil;

an amplifier for amplifying the output of the bridge balancing circuit

a demodulator for demodulating the output of the amplifier; and

a filter that filters the output of the demodulator to generate a sensor output.

12. The device of claim 11 further comprising:

a second excitation coil; and

a second sensing coil, wherein the first and second sensing coils generate signals of approximately equal amplitude and opposite phase. ~~; and~~

~~wherein the second excitation coil and the second sensing coil.~~

13. The device of claim 12 further wherein:

the first of the excitation and sensing coils are rotated at +45 degrees from an axis defined by a center axis of the shaft so as to focus on a line of compression or tension of the magnetoelastic ring;

the second of the excitation and sensing coils are rotated at -45 degrees from the axis defined by the center axis of the shaft so as to focus on an opposite of the line of compression or tension focused upon by the first of the excitation and sensing coils.

14. The device of claim 13 wherein the magnetoelastic ring is divided into a first and a second magnetoelastic ring, the first magnetoelastic ring having the first excitation and sensing coils focused upon it and the second magnetoelastic ring having the second excitation and sensing coils focused upon it.

15. The device of claim 13 wherein the first and second excitation coils are spaced apart 180 degrees along the circumference of the ring.

16. The device of claim 13 wherein the first and second excitation and sensing coils are incorporated into a single physical package.

17. The device of claim 13 wherein the magnetoelastic ring has knurled grooves over its outside diameter.

18. The device of claim 17 wherein the knurled grooves nearest the first excitation and sensing coils are disposed at +45 degrees from the axis defined by the center axis of the shaft and the knurled grooves nearest the second excitation and sensing coils are disposed at –45 degrees from the axis defined by the center axis of the shaft, such that the knurled grooves are parallel to the lines of tension and compression of the magnetoelastic ring.

19. The device of claim 13 further comprising third and fourth excitation coils and third and fourth sensing coils, the third sensing and excitation coils focused on one of a line of compression or tension of the magnetoelastic ring and the fourth sensing and excitation coils focusing on the other of the line of tension or compression of the magnetoelastic ring.

20. A device for sensing a torque applied through a shaft, the device comprising:

a shaft;

a bearing attached to the shaft comprising an inner race, an outer race and a plurality of rolling elements;

a magnetoelastic circularly polarized ring press-fit onto the inner race;

a sensor for sensing an induced axial magnetic field; and

an electric circuit that receives an output of the sensor and correlates the sensor output to the torque applied through the shaft.

21. The device of claim 20 wherein the inner race is a tapered race and the magnetoelastic ring is press fit upon a journal adjacent a small end of the tapered inner race.

22. The device of claim 20 wherein the inner race is a tapered race and the magnetoelastic ring is press fit upon a journal adjacent a large end of the tapered inner race.

23. The device of claim 20 wherein the sensor comprises an ~~the~~ excitation coil and sensing coil that are packaged into a single unit mounted to the outer race.

24. The device of claim 23 wherein the single unit is mounted within a radial bore of the outer race.

25. The device of claim 23 wherein the single unit is mounted within a counterbore of the outer race.

26. The device of claim 23 wherein the single unit is mounted within a seal mounted within the outer race.

27. The device of claim 24 further comprising a second excitation coil and second sensing coil packaged into a second unit mounted to the outer race.

28. The device of claim 20 wherein the sensor is a hall effect sensor.

29. The device of claim 20 wherein the sensor is a magnetoresistive sensor.